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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/930,521	08/15/2001	Paul A. Farrar	303.367US2	2262

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EXAMINER	
NGUYEN, HA T	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 02/27/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Action Summary	Application No. 09/930,521	Applicant(s) FARRAR ET AL.	
	Examiner Ha T. Nguyen	Art Unit 2812	

-- The MAILING DATE of this communication appears n the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 18-41 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 18-41 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 15 September 2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Pri rity under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Objections

1. Claims 27-34 are objected to for containing the following informalities: in claims 27, 29, 31, and 33, lines 2, 1, 2, 2, respectively, an insulative or insulating layer is used for both first and second trenches without distinction. The appropriate use of first and second is suggested for clarity. Claim 34 also recites "first trench" in line 2, it appears that "second trench" is more correct. Appropriate correction is required.

Claims 28, 30, 32, and 34 depend from 27, 29, 31, or 33. They are objected to for the same reason.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 18, 19, 29, 31, 33, and 38-40 are rejected under 35 U.S.C. 102(b) as being anticipated by Esquivel et al., U. S. Patent 4977439 (Hereinafter Esquivel).

[Claims 18 and 39] Referring to Figs. 2-11 or Figs. 15-19 and related text, Esquivel discloses a method comprising the steps of: a) forming at least one first trench 66-70 or 146,148 within a semiconductor substrate 62 or 144 at a first depth (see Fig. 3 or 18); b) depositing a first conductive material substantially at the bottom of each first trench 82-86 or 154, 156 (see Fig. 3 or 18); c) forming at least one second trench 64 or 162 within the semiconductor substrate at second depth shallower than the first depth (see Fig. 3 or 18); and d) depositing a second conductive material 88 or 166 substantially at the bottom of each second trench (see Fig. 3 or 18);

[Claims 19 and 40] wherein the first conductive material is identical to the second conductive material (see col. 5, lines 26-60);

[Claim 29] after depositing the second conductive material, depositing a insulative material within each second trench over the second conductive material (see col. 5, lines 61-65);

[Claim 31] after forming the at least one first trench, forming a first insulating layer at the bottom of and on walls of each first trench (see col. 5, lines 12-21);

[Claim 33] before depositing the second conductive material, forming a second insulating layer at the bottom of and on walls of each second trench (see col. 4, lines 44-45);

[Claim 38] connecting at least one of the first conductive material with at least one of the second conductive material (see fig. 11 and related text).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 20, 27, 28, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esquivel.

[Claim 20] Esquivel discloses substantially the limitations of claim 20; but it does not disclose expressly that wherein at least one of the first conductive material and the second conductive material comprises one of tungsten and a tungsten alloy;

[Claims 27 and 28] depositing a first insulative material within each first trench over the first conductive material and wherein the first insulative material comprises an oxide (See col. 5, lines 61-65); but it does not disclose expressly the claimed order of forming the first conductive material and the first insulative material and that the first insulative material is silicon dioxide;

[Claim 30] wherein the second insulative material comprises an oxide (See col. 5, lines 61-65); but it does not disclose expressly that the second insulative material is silicon dioxide; However, the missing limitations are well known in the art because Esquivel also discloses the use of WSix or Al as conductive materials (See col. 6, lines 52-60). Besides, silicondioxide is well known oxide used in the art. Selection of any order of performing process steps is primae facie obvious in the absence of new or unexpected results (See MPEP 2144.04 (d) citing *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946)).

A person of ordinary skill is motivated to modify Esquivel to use WSix as conductive material because both TiSix and WSix are equivalently well known and used in the art.

Therefore, it would have been obvious to use Esquivel's teaching to obtain the invention as specified in claims 20, 27, 28, and 30 .

6. Claims 21 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of , as applied to claims 18-20, 27-31, 33, and 38-40 above, and further in view of Liu et al. , U.S. Patent 6037257 (hereinafter Liu).

Esquivel discloses substantially the limitations of claims 21 and 24, as shown above.

But it does not disclose expressly the use of seed layer to facilitate the deposition of the first and the second conductive materials.

However, the missing limitations are well known in the art because Liu discloses these features (See col. 5, lines 1-9), especially when there is a desire for a low resistivity and the conductive materials used is copper.

A person of ordinary skill is motivated to modify Esquivel with Liu to obtain reliable and low resistivity interconnects .

Therefore, it would have been obvious to combine Esquivel with Liu to obtain the invention as specified in claims 21 and 24.

7. Claims 21-26, 35, 36, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esquivel, as applied to claims 18-20, 27-31, 33, and 38-40 above, in view of Gonzales, U S Patent 5497017.

Esquivel discloses substantially the limitations of claims 21-26, 35, 36, and 41, as shown above.

But it does not disclose expressly the use of seed layer and the details about the method of depositing the first and the second conductive materials.

However, the missing limitations are well known in the art because Gonzales discloses these features (See col. 5, lines 1-9), the examiner interprets TiN to be equivalent to the seed layer because of the adhesive characteristic of TiN, W can be more easily deposited on the substrate. The combined teaching does not teach a selective deposition method.

However, it would be obvious for a person of ordinary skill in the art to use selective deposition when it is desired to reduce the cost of material used.

A person of ordinary skill is motivated to modify Esquivel with Gonzales to obtain more reliable interconnects with better adhesion.

Therefore, it would have been obvious to combine Esquivel with Gonzales to obtain the invention as specified in claims 21-26, 35, 36, and 41.

8. Claims 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esquivel, as applied to claims 18-20, 27-31, 33, and 38-40 above, in view of Yamamoto et al., U.S. Patent 5410169 (Hereinafter Yamamoto).

Esquivel discloses substantially the limitations of claims 32 and 34, as shown above.

But it does not disclose expressly that the first and second insulating layers are formed by oxidizing the bottom of and the walls of each first and each second trench.

However, it is well known in the art because Yamamoto discloses the forming of an oxide liner by thermal oxidation (See col. 3, lines 44-48 and figs. 7B,C).

A person of ordinary skill is motivated to modify Esquivel with Yamamoto to obtain dense oxide liner of good quality.

Therefore, it would have been obvious to combine Esquivel with Yamamoto to obtain the invention as specified in claims 32 and 34 .

9a. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Esquivel, as applied to claims 18-20, 27-31, 33, and 38-40 above, in view of Gaul, U.S. Patent 5646067.

Esquivel discloses substantially the limitations of claim 37, as shown above.

But it does not disclose expressly that the substrate is part of a wafer having a front side and a back side, and further comprising the step of thinning the back side of the wafer to expose at least one of the first conductive material and the second conductive material.

However, it is well known in the art because Gaul discloses these features (See figs. 2B-2D and related text).

A person of ordinary skill is motivated to modify Esquivel with Gaul to obtain more connection in less space.

Therefore, it would have been obvious to combine Esquivel with Gaul to obtain the invention as specified in claim 37 .

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Primary Examiner

Ha Nguyen

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